



Quiet Fan Technology for Deep Space Missions

PROJECT MANAGER: Chris Allen · 281-483-9710 · christopher.s.allen@nasa.gov

PROJECT ENGINEER: Andrew Boone · 281-483-8711 · andrew.j.boone@nasa.gov

HAT: 6.3 e-E, 6.1 b-E TA: 6.1.4 quiet fans, lightweight crew quarters TRL: start 4 / current 6

OVERVIEW

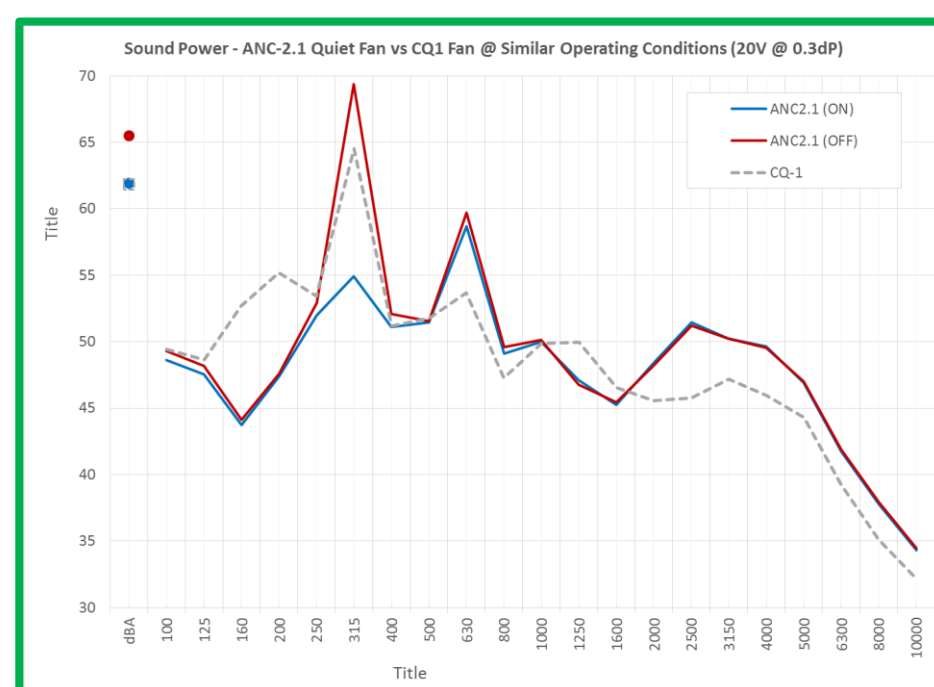
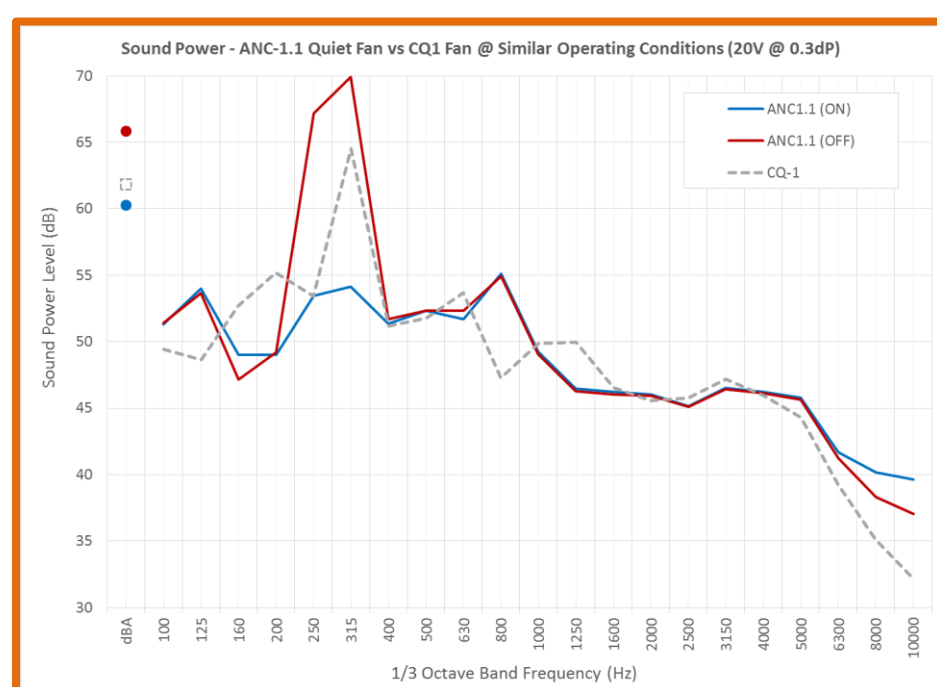
Reducing ambient noise levels in space environments plays a key role in crew communications, ability to sleep, and overall crew comfort and well-being. Deep space missions are especially susceptible to noise due to the confined nature of their environment and the lack of respite from noise. This technology is significant to deep space missions because it can reduce fan noise within the existing hardware footprint, reducing the need for bulky passive treatments such as added duct work & internal linings.

INNOVATION

Recent advances in an Active Noise Control (ANC) quiet fan technology developed by RotoSub, uses magnets imbedded in a fan's blades to turn the fan into a noise canceling speaker. Working with RotoSub our goal was to adapt this technology to the Crew Quarters (CQ) type fans and demonstrate this technology in the ISS Node 2 CQ Mockup in Building 9.

OUTCOME

- Working with RotoSub we successfully demonstrated this technology by integrating it in four CQ type fans.
- Two **single modulation** loop and two **dual modulation** loop fans were developed, with tonal noise reduction being achieved in both systems (see below).

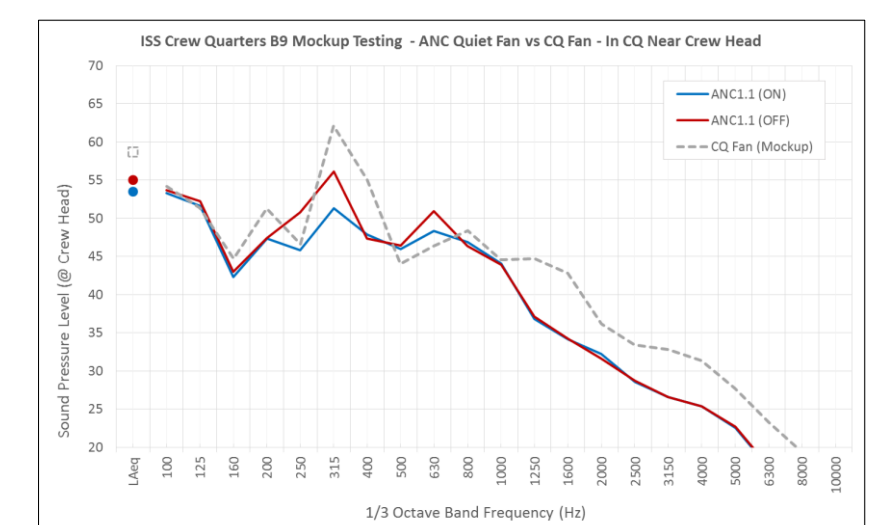
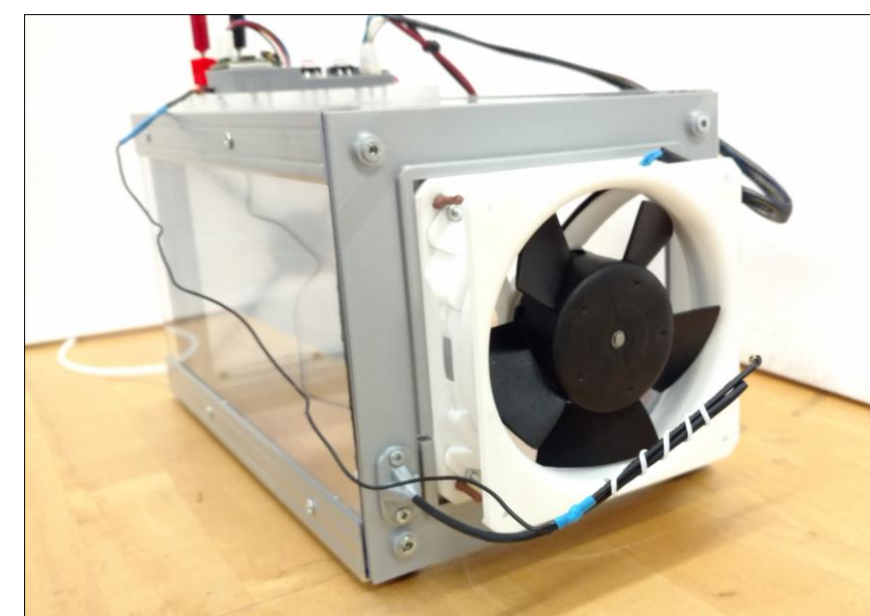


INFUSION SPACE / EARTH

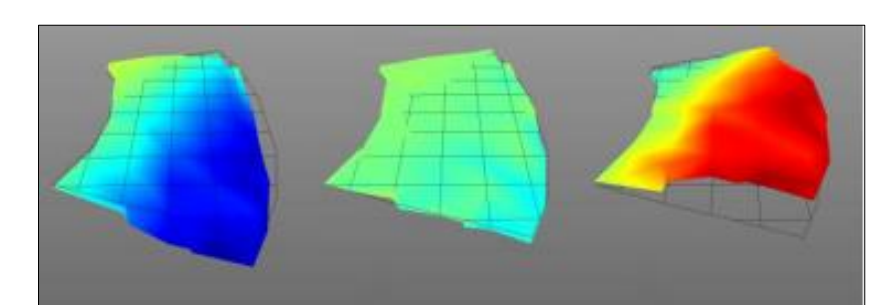
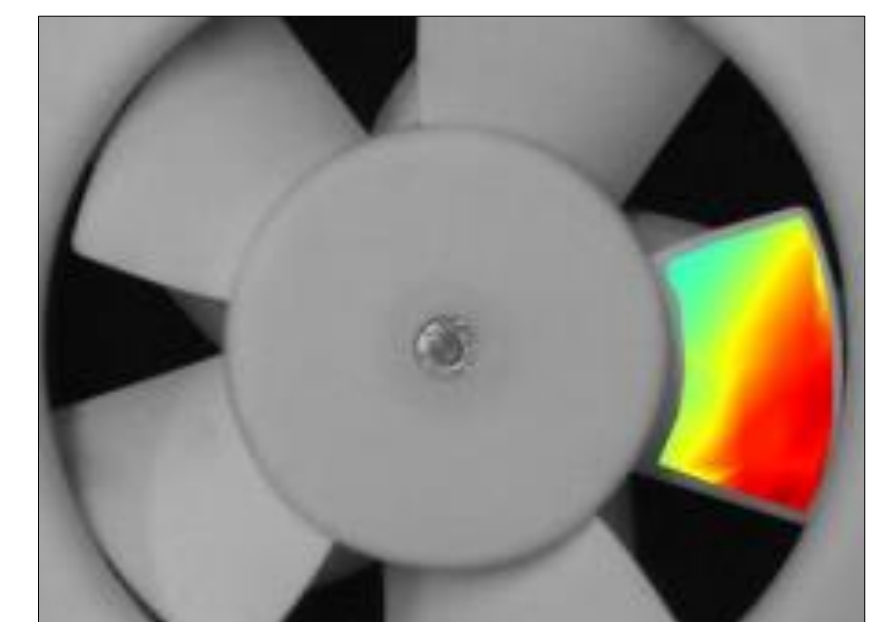
The development of this quiet fan technology for space will be especially important for deep space exploration, where mass and volume savings are worth a premium.



Movement of fan blade tips via embedded magnets produce the noise cancelation signal →



Testing of ANC quiet fan in CQ mockup ← ↑



PARTNERSHIPS / COLLABORATIONS

We partnered with Lars Strömbäck and RotoSub AB out of Sweden to adapt and integrate their ANC quiet fan technology into CQ type fans. We also worked with Jim Broyan and the EC7 team to better understand the CQ fan operational parameters and constraints. Lastly, we worked with Danielle Koch from the NASA Glenn Research Center for the loan of their ISO 10302 Fan Sound Power Plenum for baseline fan testing.

FUTURE WORK

This project was awarded a second year of funding. For this second year we are working with RotoSub to develop a flight ready fan system based on the existing CQ fans. The intent is to certify and fly these fans as a technology demonstration, where they would replace the two existing CQ fans in one of the ISS Crew Quarters. Future development will include modifying the CQ fan blade design to be better optimized for this technology, and developing a more robust non-ferrous fan housing to improve durability.